AF/1733 #

Attorney's Docket No: 07977-263001 / US4563

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant : Yamazaki, et al. Art Unit : 1733
Serial No. : 09/760,499 Examiner : John L. Goff
Filed : January 11, 2001
Title : DISPLAY DEVICE AND METHOD OF MANUFACTURING THE SAME

Mail Stop Appeal Brief - Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

BRIEF ON APPEAL

(1) Real Party in Interest

Semiconductor Energy Laboratory Co., Ltd. is the real party in interest.

(2) Related Appeals and Interferences

There are no related appeals or interferences.

(3) Status of Claims

Claims 1-43 are pending, with claims 1, 4, 26, and 36 being independent.

Claims 7-15, 20, 25, 31, 35, and 43 are currently withdrawn from consideration.

All of the pending and non-withdrawn claims 1-6, 16-19, 21-24, 26-30, 32-34 and 36-42 stand rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent 5,821,138 to Yamazaki (Yamazaki '138) in view of admitted prior art and U.S. Patent No. 5,757,456 to Yamazaki (Yamazaki '456).

(4) Status of Amendments

The claims have not been amended subsequent to the final rejection.

(5) Summary of Invention

The present application describes methods of manufacturing a display device. A light-emitting element is formed over a heat-resistant substrate, such as, for example, glass. In this way, advantages of high-temperature manufacturing processes may be realized. Then, a flexible substrate, such as, for example, types of plastic, may be formed over the light-emitting element.

Then, the original, heat-resistant substrate is removed, and replaced with a flexible substrate. In this way, the light-emitting element is sandwiched between two flexible substrates, and may thereby be incorporated into flexible displays. In this way, such flexible displays may be obtained (e.g., such as might be incorporated into the windshield of an automobile), without sacrificing the advantages of the high-temperature manufacturing processes for light-emitting elements, referenced above.

As shown in FIGS. 1A-1E and 2A-2C, for example, such methods may include forming a peeling layer (102) on a first substrate (101). An insulating layer (103) is formed on the peeling layer (102). Then, a light emitting element is formed on the insulating layer (103), where the light emitting element may be an electroluminescent device (EL device) that includes a pixel electrode (anode) (124), an organic electroluminescent layer (127), and a cathode (128). Then, a second substrate (130) is bonded over the light emitting element (124, 127, 128) using a first adhesive (129). After this bonding of the second substrate (130), the peeling layer (102) is exposed to a gas containing halogen fluoride, so that the peeling layer (102) and the first substrate (101) are removed. Then, a third substrate (132) is bonded to the insulating layer (132) by using a second adhesive (131).

Each of the independent claims 1, 4, 26, and 36 recite the feature that a light-emitting element (e.g., EL element or display element) is formed over an insulating layer/peeling layer /substrate combination. These claims further recite that, subsequently, a second substrate is bonded over the light-emitting element, and that, subsequently, the peeling layer/substrate combination is removed from the other side of the light-emitting element, and replaced with a third substrate.

(6) Issues

Would the subject matter of independent claims 1, 4, 26, and 36 been obvious over Yamazaki '138 in view of admitted prior art and Yamazaki '456?

(7) Grouping of Claims

The claims stand or fall together.

(8) Argument

With respect to the final rejection of claims 1-6, 16-19, 21-24, 26-30, 32-34 and 36-42 under 35 U.S.C. 103(a) as being unpatentable over Yamazaki '138 in view of admitted prior art and Yamazaki '456, Applicant respectfully submits that the Examiner has failed to establish a prima facie case of obviousness. Specifically, Applicant submits that the rejection suffers from impermissible hindsight, fails to consider all of the cited references (including those portions of the reference that teach away from the claimed invention), and does not provide proper motivation for modifying Yamazaki '138 in the proposed manner.

Yamazaki '138 primarily discloses techniques for forming liquid-crystal display units, such as might be used in flexible displays (see, e.g., column 6, lines 37-45, as well as FIGS. 8-10). It should be understood, and Applicant believes that the Examiner does not dispute, that liquid-crystal elements do not meet the definition of "light-emitting element" or "light-emitting layer" as referred to above and as recited in independent claims 1, 4, and 36. That is, liquid-crystal elements are generally known to transmit (and act upon) light obtained from another source, and do not themselves emit light. Additionally, it is know that certain "active-matrix" type liquid crystal panels may be formed from two separately-formed panels, which may be joined together, so that a liquid crystal material may be implanted therebetween to complete the display unit.

Accordingly, Yamazaki '138 discloses (see, e.g., FIGS. 2A-2C, 3A-3B, and 4) formation of a peeling layer (102) on top of a (e.g., glass) substrate (101). Then, as shown in FIGS. 2A-2B, a first portion of a liquid-crystal element is formed over the peeling layer (102). Then, as shown in FIG. 2C, a plastic substrate (120) is formed over the structure of FIG. 2B, whereupon, as shown in FIG. 3A, the peeling layer (102) and substrate (101) are removed.

Thus, a first panel of a liquid crystal display is obtained. Specifically, with emphasis added, "a state shown in FIG. 3B is obtained. In this state, one of the active matrix liquid-crystal display panels has been completed. In other words, one of liquid-crystal panels with a structure in which liquid crystal is interposed and held between a pair of substrates has been completed" (Yamazaki '138, column 9, lines 42-46). Then, as shown in FIG. 4, a second panel (including, e.g., an orientation film 122, an opposing electrode 123, and a plastic film 124) is attached to the

first panel, and "...liquid crystal is implanted in a gap therebetween. Thus, the liquid-crystal display panel shown in FIG. 4 is completed" (Yamazaki '138, column 9, lines 59-61).

Based on the above description, Applicant submits that Yamazaki '138 discloses, at best, formation of a portion of a liquid crystal element that is covered with flexible substrate 120, followed by use of the peeling layer (102) to remove substrate (101). Thus, formation of the liquid crystal display (e.g., addition of the second panel 122/123/124 and implantation of liquid-crystal material) does not occur until after the addition of the substrate 120 and the peeling of the layer 102 (to remove substrate 101).

The Examiner admits that Yamazaki '138 does not disclose "...including a light-emitting element in the display device" (see Final Office Action of September 3, 2003, page 3, lines 8-10). The Examiner further agrees that Yamazaki '138 discloses formation of the liquid crystal element after removal of the first substrate (101), and not before (see, e.g., Final Office Action of September 3, 2003, page 4, lines 16-17).

Thus, in order to reject independent claims 1, 4, 26, and 36, the Examiner attempts to establish a prima facie case of obviousness in which the techniques of Yamazaki '138 are modified to form an EL device according to the limitations of those claims. Specifically, the Examiner first points to column 6, lines 45-49 of Yamazaki, which states "a technique described in this specification is available to the EL-type display unit," and then states that the admitted prior art is directed to known EL display devices (see Final Office Action of September 3, 2003, page 3, lines 10-19).

In response, Applicant submits that the referenced statement from Yamazaki '138 appears to be the only reference therein to the formation of an EL-type display unit, and that Yamazaki '138 does not disclose any discussion or explanation as to what methodology is or is not included within "the technique" of the Yamazaki '138 specification, or how "the technique" might be used to form an EL-type display unit. In other words, although Yamazaki '138 discloses that "a technique described in this specification is available to the EL-type display unit," the initial rejection included in the Office Actions of February 26, 2003 contained no discussion as to why an artisan of ordinary skill would have been motivated to use "the technique" of Yamazaki '138 to construct an EL-type display unit in accordance with the limitations of claims 1, 4, 26, or 36, and, in particular, contained no discussion as to why such an

artisan would have formed the EL element prior to an addition of the claimed second substrate and prior to the recited removal of the peeling layer (and underlying first substrate).

Additionally, as Applicant pointed out in the Response of January 5, 2004, Yamazaki '138 does not disclose or properly suggest the recited "third substrate" of independent claims 1, 4, 26, and 36. For example, the purpose of formation of the plastic film (124) of Yamazaki '138 is to allow the liquid crystal layer (125) of that reference to be interposed between the plastic film (124) and a silicon dioxide film (103). Therefore, if Yamazaki '138 were modified to include a light-emitting element in place of the liquid crystal layer 125, the stated reason of Yamazaki for including the PET film 124 would no longer exist. As a result, the pending rejection fails to consider all of the cited references, including those portions of the reference that teach away from the claimed invention.

The Final Office Action of September 3, 2003 included a "Response to Arguments" section on pages 4-5, in which the Examiner takes the position that, with emphasis added, "Yamazaki '138 as modified by the admitted prior art discloses ... (that) ... the light emitting element **must** be completed prior to bonding the second substrate, as this is when the anode layer is formed, which is before peeling the first substrate. Additionally, it is also noted that in Yamazaki '138 as modified by the admitted prior art if the light-emitting element were completed after the first substrate was removed, i.e., the EL material and cathode were added after peeling, the resulting EL device would be **inoperable**." Finally, the Office Action refers to "admitted prior art" for the teaching that "it is desirable to form the EL device...on a plastic substrate...with low heat resistance. However, because of the high temperatures involved in forming the EL device it has not been possible to satisfactorily form an EL device on a plastic substrate. Thus...the method taught by Yamazaki '138 as modified by the admitted prior art would include completing the light emitting element prior to peeling the first substrate as the formation of the light emitting element is a high temperature process that could not be performed directly on the plastic substrate because of the plastic's low heat resistance" (see Final Office Action of September 3, 2003, page 5, lines 3-22).

In short, the Examiner takes the following position(s): that "the technique" of Yamazaki '138, if used to form an EL device, would necessarily result in the claimed invention, in order for such an EL device to be operable, and, further, that Applicant's statements to the effect that glass

substrates may be used in higher-temperature processing environments than plastic films necessarily implies formation of the EL element prior to formation of the layer 120 of Yamazaki '138, and prior to removal of peeling layer 102 (and glass substrate 101) of Yamazaki '138.

In response to these arguments, and contrary to them, Applicant submits that there are multiple methods by which "the technique" of Yamazaki '138 might have been applied in the formation of an EL device, and that the Examiner has selected Applicant's claimed method from among these multiple methods only with the benefit of impermissible hindsight.

For example, "the technique" of Yamazaki '138 may have been used to form an EL device according to the following technique. First, a part of the EL device may have been formed on the peeling layer (102)/substrate (101) structure, and the second substrate (120) may have been bonded over the part of the EL device. Then, the peeling layer (102)/substrate (101) structure may have been removed (peeled away), and a third substrate (124) may have been added in its place (where liquid crystal material (125) is not included for forming the EL device). Then, the second substrate (120) may have been removed, so that formation of the EL device may have been completed. Then, a fourth substrate may have been added over the formed EL device (element), and the device thereby completed.[1]

Applicant submits that this example technique is consistent with "the technique" of Yamazaki '138, particularly since both the example technique and Yamazaki '138 disclose formation of a part of a display element prior to removal of a peeling layer (and underlying substrate). Applicant further submits that this example technique refutes the Examiner's stated position(s) that: (1) a modification of Yamazaki '138 to form an EL device must result in Applicant's claimed invention (in order to avoid inoperability of the resulting EL device), and (2) the method of Yamazaki '138 as modified by the admitted prior art would include completing the light emitting element prior to peeling the first substrate, since the formation of the light

[1] The cited technique is illustrated in commonly-assigned U.S. Publication 2003/0217805, attached as Appendix B, which was filed May 16, 2003, and, therefore, is not prior art to the pending application. Specifically, the technique is shown in FIGS. 6A-6B and 7A-7B of the referenced publication, as such: in FIG. 6A, a second substrate (211) is bonded before formation of light-emitting element (316). A first substrate (100) is removed, and then, as shown in FIG. 6B, a third substrate (213) is bonded in its place and the second substrate (211) is removed. Then, the light-emitting element (316) is completed, as shown in FIG. 7A. Finally, a fourth substrate (318) is formed as shown in FIG. 7B.

emitting element is a high temperature process that could not be performed directly on the plastic substrate.

In the Advisory Action of February 5, 2004, the Examiner reiterated many of the arguments above, and added the position that "Yamazaki '138 teaches forming a 'flexible' display device... (that) ... should be thin and light in weight." However, again, Applicant points out that these advantages may be gained without use of Applicant's claimed invention, as illustrated by the example technique discussed above.

Based on the above, Applicant respectfully submits that none of the cited references properly suggest formation of a display element prior to removal of a peeling layer (and underlying substrate), as alleged by the Examiner and as recited in independent claims 1, 4, 26, and 36. Specifically, Yamazaki '138 merely discloses formation of a part of a display element prior to removal of a peeling layer (and underlying substrate), and the display element is not completed until after this removal. Meanwhile, Applicant's "admitted prior art" merely discloses a structure of an example of an EL device, and Applicant's other statements within the "Description of the Related Art" of pages 1-2 of Applicant's specification (e.g., statements regarding the problem of using high-temperature processing techniques in combination with plastic films having a low heat resistance) do not constitute admitted prior art, but rather reflect Applicant's own work and efforts in developing techniques for forming display elements.

Moreover, Applicant's statements of problems to be solved do not, by themselves, suggest any particular solution to these problems, much less Applicant's claim limitations. This is particularly apparent from consideration of the facts outlined above, i.e., the cited example illustrates that the Examiner is incorrect in maintaining the necessity of including all the limitations of claims 1, 4, 26, and 36 in the proposed modification of Yamazaki '138, and that, to the contrary, all of the advantages of Yamazaki '138 (e.g., flexible, lightweight displays) may be obtained without at least some of the limitations of claims 1, 4, 26, and 36.

Finally, Applicant notes that Yamazaki '456 is cited merely for the proposition that halogen fluoride gas may be used to remove a peeling layer and underlying substrate, and does not address or cure the defects of the pending rejection(s), as they are discussed above.

As a result, Applicant submits that the pending rejection fails to establish proper motivation for modifying Yamazaki '138 in the manner suggested, and, instead (and contrary to

at least some of the teachings of that reference), uses impermissible hindsight to modify Yamazaki '138 and thereby obtain Applicant's claimed invention. Accordingly, Applicant respectfully submits that the rejections of claims 1, 4, 26, and 36 should be reversed, along with the rejections of the claims that depend therefrom.

The brief fee of $330 is enclosed along with a Four-Month Extension of Time and $1480.00 fee. Please apply any other charges or credits to Deposit Account No. 06-1050.

Respectfully submitted,

Date: September 3, 2004

William G. Hughes, Jr.
Reg. No. 46,112

Customer No. 26171
Fish & Richardson P.C.
1425 K Street, N.W.
11th Floor
Washington, DC 20005-3500
Telephone: (202) 783-5070
Facsimile: (202) 783-2331
WXH/adt
40239446.doc

APPENDIX A

Appendix of Claims

1. A method of manufacturing a display device, comprising:

forming a peeling layer on a first substrate;

forming an insulating layer on said peeling layer;

forming a light emitting element on said insulating layer;

bonding a second substrate over said light emitting element by using a first adhesive;

exposing the peeling layer to a gas containing halogen fluoride after bonding said second substrate to thereby remove said peeling layer and the first substrate; and

bonding a third substrate to said insulating layer by using a second adhesive.

2. A method according to claim 1, wherein said first adhesive is selected from the group consisting of polyimide, acrylic, and epoxy resin.

3. A method according to claim 1, wherein the third substrate comprises the same material as the second substrate.

4. A method of manufacturing a display device, comprising:

forming a peeling layer on a first substrate;

forming an insulating layer on said peeling layer;

forming a semiconductor element on said insulating layer;

forming at least one interlayer insulating film over the semiconductor element;

forming a light emitting element over the interlayer insulating film, the light emitting element electrically connected to said semiconductor element;

bonding a second substrate over said light emitting element by using a first adhesive;

exposing the peeling layer to a gas containing halogen fluoride after bonding said second substrate to thereby remove said peeling layer and first substrate; and

bonding a third substrate to said insulating layer by using a second adhesive.

5. A method according to claim 4, wherein said first adhesive is selected from the group consisting of polyimide, acrylic, and epoxy resin.

6. A method according to claim 4, wherein the third substrate comprises the same material as the second substrate.

7-15 (Withdrawn)

16. A method according to claim 1, wherein the first substrate is selected from the group consisting of glass, quartz, silicon, metal, and ceramic substrates.

17. A method according to claim 1, wherein the second substrate is selected from the group consisting of plastic, glass, quartz, silicon, metal, and ceramic substrates.

18. A method according to claim 1, wherein the peeling layer comprises silicon.

19. A method according to claim 1, wherein the insulating layer comprises silicon and oxygen.

20. (Withdrawn)

21. A method according to claim 4, wherein the first substrate is selected from the group consisting of glass, quartz, silicon, metal, and ceramic substrates.

22. A method according to claim 4, wherein the second substrate is selected from the group consisting of plastic, glass, quartz, silicon, metal, and ceramic substrates.

23. A method according to claim 4, wherein the peeling layer comprises silicon.

24. A method according to claim 4, wherein the insulating layer comprises silicon and oxygen.

25. (Withdrawn)

26. A method of manufacturing a display device, comprising:

forming a peeling layer on a first substrate;

forming an insulating layer on the peeling layer;

forming a switching element on the insulating layer;

forming at least one interlayer insulating film over the switching element;

forming a display element over the interlayer insulating film, the display element electrically connected to the switching element;

bonding a second substrate over the display element by using a first adhesive;

exposing the peeling layer to a gas containing halogen fluoride after bonding the second substrate to thereby remove the peeling layer and the first substrate; and

bonding a third substrate to the insulating layer by using a second adhesive.

27. A method according to claim 26, wherein the first substrate is selected from the group consisting of glass, quartz, silicon, metal, and ceramic substrates.

28. A method according to claim 26, wherein the second substrate is selected from the group consisting of plastic, glass, quartz, silicon, metal, and ceramic substrates.

29. A method according to claim 26, wherein the third substrate comprises the same material as the second substrate.

30. A method according to claim 26, wherein said first adhesive is selected from the group consisting of polyimide, acrylic, and epoxy resin.

31. (Withdrawn)

32. A method according to claim 26, wherein the display device is an electroluminescence display device.

33. A method according to claim 26, wherein the peeling layer comprises silicon.

34. A method according to claim 26, wherein the insulating layer comprises silicon and oxygen.

35. (Withdrawn)

36. A method of manufacturing a display device comprising:

forming a peeling layer on a first substrate;

forming an insulating layer on the peeling layer;

forming active layers, a gate insulating layer, and gate electrodes over the insulating layer;

forming a first interlayer insulating layer to cover the gate electrodes;

forming wirings and pixel electrodes over the first interlayer insulating layer, the wirings and the pixel electrodes electrically connected with the active layers, respectively;

exposing the peeling layer to a gas containing halogen fluoride to thereby remove the peeling layer;

forming a light emitting layer and a cathode on at least one of the pixel electrodes electrode;

bonding a second substrate on the cathode by using a first adhesive;

removing the first substrate after bonding the second substrate; and

bonding a third substrate to the insulating layer by using a second adhesive.

37. A method according to claim 36, wherein the first substrate is selected from the group consisting of glass, quartz, silicon, metal, and ceramic substrates.

38. A method according to claim 36, wherein the second substrate is selected from the group consisting of plastic, glass, quartz, silicon, metal, and ceramic substrates.

39. A method according to claim 36, wherein the third substrate comprises the same material as the second substrate.

40. A method according to claim 36, wherein said first adhesive is selected from the group consisting of polyimide, acrylic, and epoxy resin.

41. A method according to claim 36, wherein the peeling layer comprises silicon.

42. A method according to claim 36, wherein the insulating layer comprises silicon and oxygen.

43. (Withdrawn)

APPENDIX B

Copy of U.S. Publication 2003/0217805